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UNITED STATES
DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

Washington, D. C.

Issued February 1940

HANDBOOK OF OFFICIAL
UNITED STATES STANDARDS
FOR
QUALITY OF CREAMERY
BUTTER

Effective April 1, 1939



UNITED STATES
DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

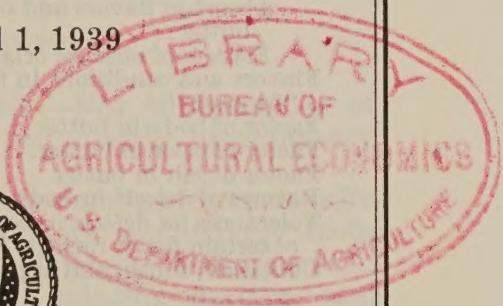
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CONTENTS

	Page
United States standards for quality of creamery butter	1
Terms defined.....	1
United States grades for creamery butter.....	2
Basis for determination of quality of creamery butter.....	4
Ratings of certain identified flavors in creamery butter.....	4
Flavors and conditions in butter that cause it to be classified as "no grade".....	7
Ratings for defects in body, color, and salt.....	7
Defects permitted in body, color, and salt without causing official United States score to be placed below flavor rating	8
Application of general rule.....	9
Explanation of United States standards for quality of creamery butter.....	11
New features embodied in revised standards.....	11
The factor of flavor.....	12
Classification of flavors according to origin.....	13
Flavors from action of micro-organisms.....	13
Flavors from mechanical causes.....	14
Flavors from chemicals and chemical changes.....	15
Flavors caused by feed conditions.....	17
Absorbed flavors and odors that are throughout the mass of butter.....	18
Flavors of obscure origin.....	19
Flavors and conditions in butter that cause it to be classified as "no grade".....	20
Factor of body in butter.....	22
Factor of color in butter.....	26
Factor of salt in butter.....	27
Ratings of defects in body, color, and salt.....	27
Tolerances for defects in body, color, and salt permitted in butter of certain flavor ratings.....	28
Container, finish, and appearance.....	29

UNITED STATES STANDARDS FOR QUALITY OF CREAMERY BUTTER¹

By virtue of the authority vested in the Secretary of Agriculture by the provision in the act of Congress entitled "An Act Making Appropriations for the Department of Agriculture and for the Farm Credit Administration for the fiscal year ending June 30, 1939, and for other purposes" (52 Stat. 710), approved June 16, 1938, authorizing an inspection service for farm products, I, H. A. Wallace, Secretary of Agriculture, do prescribe and promulgate the following standards for quality of creamery butter, that shall be employed for the grading and certification of creamery butter by official graders of the United States Department of Agriculture, to be effective on April 1, 1939, and thereafter unless amended or superseded by standards hereafter prescribed and promulgated under such authority. These standards shall supersede all standards for quality of creamery butter previously promulgated.

TERMS DEFINED

Section 55.41. Terms defined.—For the purpose of the United States standards² for quality of creamery butter:

(a) **Butter.**—Butter shall be the food product usually known as butter, and which is made exclusively from milk or cream, or both, with or without common salt, and with or without additional coloring matter, and containing not less than 80 percent by weight of milk fat, all tolerances having been allowed for.³

(b) **Creamery butter.**—Creamery butter shall be butter manufactured in a commercial creamery.

(c) **United States score grade.**—The United States score grade of a lot of creamery butter consisting of

¹ This supersedes Service and Regulatory Announcements (Markets) No. 51.

² The specifications of these standards shall not excuse failure to comply with the provisions of the Federal Food and Drugs Act.

³ In conformity with an act of Congress approved March 24, 1923.

packages of the same official United States score shall be expressed in terms of an official United States score using whole numbers only. The United States score grades shall be from U. S. 85 score to U. S. 93 score, inclusive.⁴

UNITED STATES GRADES FOR CREAMERY BUTTER

Section 55.42. United States grades for creamery butter.—The following United States grades for creamery butter are established:

(a) **U. S. 93 score** butter shall possess a fine flavor. It may possess a very slightly normal feed or slightly cooked flavor. It is made from cream to which a culture (starter) may or may not have been added. The total permitted defects in body, color, and salt are limited to a rating of one-half (tables 1 and 2).

(b) **U. S. 92 score** butter shall possess a pleasing flavor. It may possess a slightly normal feed, slightly storage, slightly heated cream (summer defect), slightly flat, slightly coarse-acid, or a definitely cooked flavor. The total permitted defects in body, color, and salt are limited to a rating of one-half unless the flavor rating is sufficiently high to permit the total ratings for defects in these factors to exceed one-half; *Provided, however,* that the total ratings for defects in body, color, and salt must not exceed 1 in 92 score butter regardless of the flavor rating (tables 1 and 2).

(c) **U. S. 91 score** butter shall possess a fairly pleasing flavor. It may possess any of the following flavors if present only to a slight degree: Acidy, utensil, scorched, neutralizer, aged (butter), greasy, woody, bitter, and old-cream. It may possess any of the following flavors even when present to a definite degree: Storage, normal feed, heated cream (summer defect), flat, coarse-acid, and smothered. The total permitted defects in body, color, and salt are limited to a rating of one-half unless the flavor rating is sufficiently high to permit the total ratings for defects in these factors to exceed one-half (tables 1 and 2).

(d) **U. S. 90 score** butter shall possess a fairly pleasing flavor. It may possess any of the following flavors if present only to a slight degree: Cabbage, turnip, potato, rape, weedy (ordinary-common), and musty. It may possess any of the following flavors even when

⁴ Secs. 55.41 to 55.48 issued under the authority contained in 52 Stat. 740.

present to a definite degree: Acidy, utensil, scorched, neutralizer, aged (butter), greasy, woody, bitter, and old-cream. The total permitted defects in body, color, and salt are limited to a rating of one-half unless the flavor rating is sufficiently high to permit the total ratings for defects in these factors to exceed one-half (tables 1 and 2).

(e) **U. S. 89 score** butter may possess any of the following flavors if present only to a slight degree: Fruity, yeasty, cheesy, oily, metallic, and barny. It may possess any of the following flavors even when present to a definite degree: Sour, scorched-neutralizer, scorched-old-cream, alkaline, cabbage, turnip, potato, rape, weedy (ordinary-common), musty, and stale-cream. The total permitted defects in body, color, and salt are limited to a rating of one unless the flavor rating is sufficiently high to permit the total ratings for defects in these factors to exceed 1 (tables 1 and 2).

(f) **U. S. 88 score** butter may possess a slightly obnoxious weed flavor or any of the following flavors even when present to a definite degree: Fruity, yeasty, cheesy, oily, metallic, cabbage, turnip, potato, rape, and barny. It may possess any of the following flavors even when present to a pronounced degree: Alkaline, musty, and stale-cream. The total permitted defects in body, color, and salt are limited to a rating of one unless the flavor rating is sufficiently high to permit the total ratings for defects in these factors to exceed 1 (tables 1 and 2).

(g) **U. S. 87 score** butter may possess a fishy, onion, and garlic flavor if present only to a slight degree. It may possess an obnoxious weed and barny flavor even when present to a definite degree. It may also possess a yeasty and cheesy flavor when present to a pronounced degree and a stale-cream flavor when present to a very pronounced degree. The total permitted defects in body, color, and salt are limited to a rating of 2 unless the flavor rating is sufficiently high to permit the total ratings for defects in these factors to exceed 2 (tables 1 and 2).

(h) **U. S. 86 score** butter may possess any of the following flavors: Definitely fishy, definitely onion or garlic, and pronouncedly obnoxious weeds. The total permitted defects in body, color, and salt are limited to a rating of 2 unless the flavor rating is sufficiently high to permit the total ratings for defects in these factors to exceed 2 (tables 1 and 2).

(i) **U. S. 85 score** butter may possess a pronouncedly obnoxious weed, onion, and garlic flavor. The total permitted defects in body, color, and salt are limited to a rating of 3 unless the flavor rating is sufficiently high to permit the total ratings for defects in these factors to exceed 3 (tables 1 and 2).

(j) **No grade.**—Butter that is below the requirements of U. S. 85 score because of its flavor or other conditions or because of excessive defects in body, color, and/or salt shall be classified as "no grade."⁵

BASIS FOR DETERMINATION OF QUALITY OF CREAMERY BUTTER

Section 55.43. Basis for determination of quality of creamery butter.—The basis for determination of quality of creamery butter, except "no grade" butter, shall be the ratings given the flavor and the defects in body, color, and salt. The official United States score of individual samples of creamery butter shall be determined by the following general rule:

General rule.—The official United States score of an individual sample of creamery butter shall be determined by deducting from the flavor rating ⁶ of the sample the amount that the total ratings of the defects in body, color, and salt is in excess of the ratings for defects permitted in these factors for butter of the particular flavor rating (table 1), the official United States score to be expressed as a whole number by lowering any half score to the next lower full score; *Provided, however*, that the total ratings for defects in body, color, and salt must not exceed 1 in 92 score butter regardless of the flavor rating.

RATINGS OF CERTAIN IDENTIFIED FLAVORS IN CREAMERY BUTTER

Section 55.44. Ratings of certain identified flavors in creamery butter.—The various identified flavors in butter listed below shall be rated as follows:

⁵ See sec. 55.45 for flavors and conditions that cause butter to be classified as "no grade."

⁶ When more than one flavor is discernible in a sample of butter the flavor rating for the sample shall be established on the basis of the flavor that carries the lowest rating.

<i>Identified flavor</i>		<i>Rating</i>
(a) Fine		93
(b) Pleasing		92
(c) Fairly pleasing		91-90
(d) Acidy:		
Slightly acidy		91
Definitely acidy		90
Definitely sour		89
(e) Utensil:		
Slightly utensil		91
Definitely utensil		90
(f) Fruity:		
Slightly fruity		89
Definitely fruity		88
(g) Yeasty:		
Slightly yeasty		89
Definitely yeasty		88
Pronouncedly yeasty		87
(h) Cheesy:		
Slightly cheesy		89
Definitely cheesy		88
Pronouncedly cheesy		87
(i) Cooked:		
Slightly cooked		93
Definitely cooked		92
(j) Scorched:		
Slightly scorched-acid		91
Definitely scorched-acid		90
Definitely scorched-old-cream		89
(k) Neutralizer:		
Slightly neutralizer		91
Definitely neutralizer		90
Definitely scorched-neutralizer		89
Definitely alkaline		89
Pronouncedly alkaline		88
(l) Storage:		
Slightly storage		92
Definitely storage		91
(m) Aged (butter):		
Slightly aged		91
Definitely aged		90
(n) Greasy:		
Slightly greasy		91
Definitely greasy		90
(o) Oily:		
Slightly oily		89
Definitely oily		88

<i>Identified flavor</i>		<i>Rating</i>
(p) Metallic:		
Slightly metallic	-----	89
Definitely metallic	-----	88
(q) Fishy:		
Slightly fishy	-----	87
Definitely fishy	-----	86
(r) Normal feed:		
Very slightly normal feed	-----	93
Slightly normal feed	-----	92
Definitely normal feed	-----	91
(s) Cabbage, turnip, potato, rape:		
Slightly cabbage, turnip, potato, rape	-----	90
Definitely cabbage, turnip, potato, rape	-----	89-88
(t) Weedy (ordinary-common):		
Slightly weedy	-----	90
Definitely weedy	-----	89
(u) Obnoxious weeds:		
Slightly obnoxious weeds	-----	88
Definitely obnoxious weeds	-----	87
Pronouncedly obnoxious weeds	-----	86-85
(v) Onion or garlic:		
Slightly onion or garlic	-----	87
Definitely onion or garlic	-----	86
Pronouncedly onion or garlic	-----	85
(w) Musty:		
Slightly musty	-----	90
Definitely musty	-----	89
Pronouncedly musty	-----	88
(x) Woody:		
Slightly woody	-----	91
Definitely woody	-----	90
(y) Heated cream (summer defect):		
Slightly heated cream	-----	92
Definitely heated cream	-----	91
(z) Flat:		
Slightly flat	-----	92
Definitely flat	-----	91
(aa) Coarse:		
Slightly coarse-acid cream	-----	92
Definitely coarse-acid cream	-----	91
(bb) Smothered:		
Definitely smothered	-----	91
(cc) Bitter:		
Slightly bitter	-----	91
Definitely bitter	-----	90

<i>Identified flavor</i>	<i>Rating</i>
(dd) Old-cream:	
Slightly old-cream-----	91
Definitely old-cream-----	90
(ee) Stale-cream:	
Definitely stale-cream-----	89
Pronouncedly stale-cream-----	88
Very pronouncedly stale-cream-----	87
(ff) Barny:	
Slightly barny-----	89
Definitely barny-----	88-87

FLAVORS AND CONDITIONS IN BUTTER THAT CAUSE IT TO BE CLASSIFIED AS "NO GRADE"

Section 55.45. Flavors and conditions in butter that cause it to be classified as "no grade."—Butter that possesses the following flavors or in which the following conditions are present shall be classified as "No grade."

(a) Flavors:

- Pronouncedly fishy.
- Surface taint.
- Limburger.
- Tallowy.
- Rancid.
- Paint or varnish.
- Gasoline, kerosene, or fly spray.
- Chemical.

(b) Conditions:

- Mold.
- Grains of sand.
- Splinters of wood.
- Specks of rust.
- Other foreign materials.

RATINGS FOR DEFECTS IN BODY, COLOR, AND SALT

Section 55.46. Ratings for defects in body, color, and salt.—The ratings for defects⁷ in body, color, and salt shall be established in accordance with the following rules:

Rule (a).—Gummy, leaky, spongy or weak, crumbly, or sticky body, wavy color, color specks, and sharp salt shall be rated for defects as follows:

<i>Defects</i>	<i>Rating</i>
Slight-----	½
Definite-----	1

⁷ See table (sec. 55.47) for ratings of each degree of defect in body, color, and salt.

Rule (b).—Ragged-boring, mealy or grainy, and streaked or mottled color shall be rated for defects as follows:

Slight	1
Definite	2

Rule (c).—High color (unnatural) shall be rated for defects as follows:

Pronounced	1
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Rule (d).—Gritty salt shall be rated for defects as follows:

Slight	1
Definite	2

DEFECTS PERMITTED IN BODY, COLOR, AND SALT WITHOUT CAUSING OFFICIAL UNITED STATES SCORE TO BE PLACED BELOW FLAVOR RATING

Section 55.47. Defects permitted in body, color, and salt without causing official United States score to be placed below flavor rating.—The maximum total ratings for defects in body, color, and salt permitted in butter that do not cause the official United States score of butter to be lowered below the flavor rating are indicated in table 1.

TABLE 1.—*Permitted ratings for defects in body, color, and salt.*

Flavor ratings	Maximum total ratings for defects permitted in body, color, and/or salt	Limitations of defects to 1 or more factors
93	1/2	In 1 factor only.
92	1/2	Do.
91	1/2	Do.
90	1/2	Do.
89	1	
88	1	
87	2	
86	2	
85	3	

When the sum of the ratings for the defects in body, color, and salt exceeds that permitted by table 1 for butter of a specified flavor rating, the butter shall be given an official United States score below the flavor rating in accordance with the general rule (sec. 55.43), for determining the official United States score of individual samples of creamery butter.

APPLICATION OF GENERAL RULE

Section 55.48. Application of general rule.—

TABLE 2.—*Examples illustrating application of general rule.*

Example No.	Flavor rating	Defects present in—			Total defects present	Defects permitted	Defects in excess of those permitted	Official United States score
		Body	Color	Salt				
1	93	½	0	0	½	½	0	93
2	93	0	1	0	1	½	½	92
3	93	½	1	0	1½	½	1	¹ 91
4	92	0	½	0	½	½	0	92
5	92	0	1	0	1	½	½	91
6	91	0	1	1	2	½	1½	89
7	90	1	0	0	1	½	½	89
8	89	½	½	0	1	1	0	89
9	89	1	1	0	2	1	1	88
10	88	0	2	1	3	1	2	86
11	87	2	1	0	3	2	1	86
12	87	2	2	0	4	2	2	85
13	86	1	2	0	3	2	1	85
14	85	2	2	0	4	3	1	(²)

^¹ See explanation of example 3 below for detailed information.

^² "No grade."

Examples 1, 4, and 8 are given an official United States score which is the same as the flavor rating because the defects in body, color, and salt are not in excess of those permitted in butter of the particular flavor rating. The official United States score of all other samples is lower than the flavor rating because the defects in body, color, and salt exceed those that are permitted in butter of the particular flavor rating, the excess being in the amount of one-half or more.

In example 2, the flavor rating is 93. The defects permitted in body, color, and salt for butter of that

flavor rating are limited to a maximum of one-half. The defects present in the sample amounted to 1, therefore the defects are in excess of those permitted by a total of one-half. The official United States score is lowered 1 below the flavor rating instead of one-half because the official United States score must be expressed as a whole number. In example 3, the official United States score is lowered 2 below the flavor rating instead of 1 because the total ratings for defects in body, color, and salt must not exceed 1 in 92 score butter. In example 10, the flavor rating is 88. The permitted defects in body, color, and salt for butter with a flavor rating of 88 are 1. The defects in this particular sample totaled 3 and are, therefore, in excess of those permitted by a total of 2. The official United States score, therefore, is 2 lower than 88 or 86. In example 14, the flavor rating is 85. The total permitted defects in body, color, and salt for butter with a flavor rating of 85 is 3. This butter showed defects totaling 4, or 1 in excess of those permitted in butter with a flavor rating of 85. The official United States grade of this butter is indicated by "no grade" because the application of the general rule would give this butter a score of 84. Such butter is below the requirements of U. S. 85 score because of excessive defects in body, color, and salt. Therefore, it must be classified as "no grade."

In testimony whereof I have hereunto set my hand and caused the official seal of the Department of Agriculture to be affixed in the City of Washington, this 3d day of November, 1938.

H. A. WALLACE,
Secretary of Agriculture.

EXPLANATION OF UNITED STATES STANDARDS FOR QUALITY OF CREAMERY BUTTER

The United States Standards for Quality of Creamery Butter (effective April 1, 1939) provide a more direct, definite, and accurate basis for grading creamery butter than was contained in Service and Regulatory Announcements No. 51, which since 1919 has been used by the Department of Agriculture in its butter-grading service.⁸ These standards represent a refinement and improvement of the previous standards and provide a more exact and simplified system of determining the official United States score. The correct application of these standards will require expert knowledge of the various quality characters that may be present in butter, ability on the part of graders to recognize and identify these characters, and a high degree of skill in determining the degree of their development. The use of these standards should result in a more unified, accurate, and useful grading service.

NEW FEATURES EMBODIED IN REVISED STANDARDS

An important new feature in the revised standards is a narrowing of the range of score for butter from the old basis of 75 to 95 points to a new basis of 85 to 93 points. Only 9 points in a score range (85-93) are practicable for use in grading butter. This new feature requires the elimination of the lower 10 points (75-84) and the upper 2 points in the previous range of the numerical score for butter.

A second feature is the discontinuance of the package as a factor in determining the quality of butter. The package is not a constituent part of the product and has no definite or direct influence on its quality. It would be impossible to establish uniform standards for packages that would be practicable for all channels of trade, for the present accepted commercial practices differ widely within the various channels and in different markets.

⁸ Service and Regulatory Announcements (Markets) No. 51. The inspection of butter under the Food Products Inspection Law, Washington, D. C., May 28, 1919 (out of print).

Another feature is the discontinuance of the score-card method of prorating the score to various factors and the substitution of a simple, definite, and more direct method of rating each factor. In the revised standards, flavor and the defects in body, color, and salt are rated independently, according to the standards established for them. The standards for flavor provide ratings for the different flavors and the degrees of their development. The defects in body, color, and salt are similarly rated. The official United States score of a churning or sample of butter is determined by application of a general rule after the factor of flavor and the defects in body, color, and salt have been rated.

THE FACTOR OF FLAVOR

The flavor of butter is determined primarily by the senses of taste and smell. Certain taste sensations, notably greasy and oily, are detected by the sense of touch. To register its full taste sensation a substance must be soluble so that it can be carried quickly to the taste buds on the tongue.

There are only four primary taste sensations—sweet, sour, salt, and bitter. Sugar produces the sensation of sweetness; lactic acid or a tart apple produces a sour taste; common table salt, a sensation of saltiness; and quinine produces a bitter sensation.

The sense of smell supplements taste in determining flavor in butter. The warmth of the mouth melts the butter and frees its volatile aromas which enter the olfactory chambers and come forward into the nose. Moisture in the mouth and nasal passages assists the development and transmission of flavor sensations. When melted butter comes in direct contact with the taste buds, its sweet and salty characteristics are detected by those located at the tip of the tongue, its sour characteristics by those on the sides of the tongue, and its bitter characteristics by those at the back of the tongue.

The proper procedure in grading butter is first to use the sense of smell and then the sense of taste to establish the character, probable origin, and degree of development of each flavor present. By discerning carefully the odor or aroma characteristics of the sample and the character and degree of the flavor present, the grader is able to identify and classify the flavor properly.

Aroma in butter may be present to a greater or lesser degree. In the higher grades of butter, a pleasing aroma accentuates or makes more pronounced certain pleasing or desirable flavors. An objectionable aroma or odor is generally associated with flavors present in the lower grades of butter and serves to accentuate and make more pronounced the objectionable flavor characteristics of those grades. The aroma noted in butter before it is tasted is a general indication of its quality.

CLASSIFICATION OF FLAVORS ACCORDING TO ORIGIN

Flavors in butter may be classified into six groups according to character and origin as follows: (1) Flavors from action of micro-organisms, (2) flavors from mechanical causes, (3) flavors from chemicals and chemical changes, (4) flavors caused by feed conditions, (5) absorbed flavors, and (6) flavors of obscure origin.

FLAVORS FROM ACTION OF MICRO-ORGANISMS

The flavor characteristics that result from action of micro-organisms in cream and butter vary greatly, depending on the kind of organisms present, the conditions under which their development takes place, and the extent or degree of their development.

Acid-producing bacteria under favorable conditions may produce an excessive acidity in the cream, which if not properly neutralized before pasteurization, will produce an "acidy" flavor in the butter. Underneutralization of the cream or not allowing sufficient time for the neutralizer completely to dissolve before the temperature of the cream has reached the coagulation point, usually causes an acidy flavor (slightly sour) in the finished product. An acidy flavor may also be caused by the use of what is termed a "sour starter." Holding the pasteurized cream at too high a temperature over night may also bring about this condition. An acidy flavor and aroma can readily be distinguished as the aroma is developed to a greater degree and the flavor is indicated by a slight harshness or sourness which is not pleasing to the taste.

An acidy flavor and aroma when present to a slight degree limits the rating to 91. This flavor should not be confused with that produced by a desirable flavored culture.

A "sour" flavor in butter may be caused by a sour starter, very high acid cream, or the retention of considerable quantities of buttermilk in the butter. It may also be caused by adding small quantities of sour cream, which had been previously pasteurized and turned sour, to a vat of low-acid cream. When this flavor is definite in character, it is rated 89.

The flavor termed "utensil" is characterized by a more or less "off" taste and aroma, indicating a possible lack of proper washing and sterilization of the utensils and equipment used in the handling of the milk or cream on the farm or in the creamery. Pitted and rusty cream cans may be responsible for this flavor. The maximum rating of a slightly utensil flavor is 91.

A sweetish flavor resembling the aroma or flavor of fruit is characterized as "fruity." Fruity flavors may occur in butter that has been held in cold storage for several months or longer. When the flavor is present to a slight degree, the flavor rating is limited to a maximum of 89.

A yeasty flavor in butter, due to a yeasty fermentation, is described as "yeasty." Yeasts may cause a sweetish taste in cream through the fermentation of the milk sugar as the result of enzymic action. Old yeasty cream generally imparts a bitter flavor which is carried over into the butter. This flavor, when present to a slight degree, limits the flavor rating to a maximum of 89.

A flavor that resembles the taste of cheese of the American Cheddar type is described as "cheesy." It is primarily a hot-weather defect occurring in sour, curdy cream. Excessive quantities of buttermilk in the butter, overripe and curdy starter, and excessive ripening of the cream—each or in combination—also may cause cheesy flavor. A cheesy flavor when present to a slight degree limits the flavor rating to a maximum of 89.

FLAVORS FROM MECHANICAL CAUSES

Flavors imparted to butter as a result of excessive heating of the cream or the improper application of the heating of the cream during the pasteurization process are classified as of mechanical cause.

In the pasteurization of cream for butter making the temperature attained or the application of the heat-

ing elements under certain conditions may produce a "cooked" flavor that is sometimes called a custard flavor. This flavor has a nutty character and is not considered objectionable for it usually disappears entirely after the butter is chilled for a few days. A cooked flavor is smooth to the taste and does not impart a harsh bitter aftertaste as does a "scorched" flavor. When a slightly cooked flavor is present in butter that otherwise has a fine flavor, a rating of 93 is given.

A flavor produced under similar conditions but of a more intensified character is termed "scorched." A scorched flavor may be produced by filling the vat above the coil so that proper agitation of the cream is not obtained in pasteurization. When a small volume of cream is pasteurized in a vat pasteurizer with a considerable part of the coil above the cream, the cream will tend to adhere to the hot coil, resulting in a high temperature of the adhering film of cream which may result in a scorched flavor. A scorched flavor may also be caused by too high a temperature of the water passing through the coils in relation to the temperature of the cream. Oxidized flavors of milk and cream which are largely caused by the catalytic action of copper, are known to be associated with a scorched flavor. A scorched flavor imparts a bitter, harsh taste. When this flavor is present to a slight degree and associated with acid cream, it limits the flavor rating to a maximum of 91. When associated with old cream and definite in character, it is rated 89.

FLAVORS FROM CHEMICALS AND CHEMICAL CHANGES

Certain flavors in butter may have their origin in neutralizers that are added to the cream during the process of manufacture. Other flavors may result from chemical changes that take place in the butter.

The addition of an alkali or combination of alkalies to cream to reduce the acidity of the cream before pasteurization is generally known as neutralization. This term is a misnomer; the process should be termed "standardization of acidity" since complete neutralization is not attempted in practical creamery operations. A neutralizer or alkaline flavor is generally caused by overneutralization, improper addition of neutralizer to the cream, the use of too concentrated a neutralizer solution, adding neutralizer to cold, viscous,

and lumpy cream and single neutralization of high-acid cream. Weak alkalies like sodium bicarbonate produce a sweetish taste, whereas, strong alkalies like lime produce a bitter taste. A "neutralizer" flavor when slightly perceptible limits the flavor rating to a maximum of 91. A "scorched-neutralizer" flavor is somewhat more objectionable. It is usually found in butter made from improperly neutralized sour cream. When this flavor is definite in character it is rated 89. When lime flavors are present to a pronounced degree they are characterized as "over neutralized" or "alkaline" and the flavor rating is limited to a maximum of 89.

After butter is held in cold storage for a period of time, usually several months or longer, it may develop more or less of a characteristic "storage" flavor as a result of certain chemical changes. A slight storage flavor in butter that otherwise has a pleasing flavor limits the flavor rating to a maximum of 92.

An "aged" flavor in butter is usually caused by the holding of butter for extended periods of time at relatively high temperatures or for short periods of time at abnormally high temperatures. This is especially true with certain types of butter made from cream not effectively pasteurized. This flavor can best be described by the term "lacks freshness" and should not be confused with storage flavor. When present to a slight degree this flavor limits the flavor rating to a maximum of 91.

A "greasy" flavor is usually caused by rapid heating of the cream of very high fat content, especially when a small volume of cream is pasteurized. It may also be caused by churning cream that has not been held long enough after pasteurization to produce well-chilled fat globules. In washing and working such granules there is a tendency to produce a finished product that possesses a greasy flavor. Cream held too long at too high a temperature before pasteurization or cooled too slowly after pasteurization may also produce a greasy flavor. This flavor can be likened to a mild degree of oiliness. When present to a slight degree this flavor limits the flavor rating to a maximum of 91.

An "oily" flavor is usually the result of oxidation. The equipment used in the handling and treatment of the cream before churning may provide a medium for chemical change. The presence of copper hastens the formation of an oily flavor. Butter of acid character

is less likely to become oily as acidity lessens oxidation. The pasteurization of improperly neutralized cream or of sour cream at high temperatures and the exposure of such cream to air and light may cause an oily flavor. Slow cooling of the cream after pasteurization may also cause an oily flavor. When present to a slight degree, an oily flavor limits the flavor rating to a maximum of 89.

A "metallic" flavor in butter may have its origin in chemical changes in the milk, cream, or butter or it may result from contact of milk or cream with some metallic surfaces. This flavor generally is caused by keeping milk or cream on the farm in poorly tinned containers; by keeping cream, especially if sour, in old rusty cans in the creamery before emptying it into the cream vats and by holding cream, especially sour cream, in poorly tinned vats. Contact of cream with corroded iron or copper pipes may cause the cream to develop a metallic flavor. This flavor, when present to a slight degree, limits the flavor rating to a maximum of 89.

A flavor that resembles the flavor of mackerel or herring is termed "fishy." Fishiness is favored by high acid, high salt, overworking, and the presence of iron and copper salts. It is caused by a chemical decomposition of lecithin which is an unstable nitrogenous substance in butter. While a fishy flavor may occur in fresh or reasonably fresh butter, it is primarily a storage defect. When present to a slight degree, this flavor limits the flavor rating to a maximum of 87.

FLAVORS CAUSED BY FEED CONDITIONS

Feed flavors in butter are due to these flavors being present in the milk or cream.

Most dry feeds, like hay and many of the concentrates, silage, green alfalfa, and various grasses produce a normal feed flavor in butter. Even when fed in large quantities they do not generally have more than a very slight objectionable effect on the flavor of the milk or cream. Some feed flavors are driven off during the process of pasteurization. When these flavors are present to a very slight degree and the butter otherwise has a fine flavor, a rating of 93 is given. Silage flavors may vary in degree and character depending on the time of feeding and the extent of fermentation and the kind of silage. Green alfalfa produces a mild sweet flavor which is characteristic of much of the butter pro-

duced in the irrigated valleys of the Rocky Mountain and Pacific Coast States, where it is fed extensively to milk cows. Butter produced in the spring and early summer when cattle are turned on fresh natural grass possesses a grass flavor. Natural grass imparts a pleasing high aroma which is desirable in high-scoring butter. Rank-growth grass often produces a definitely bitter flavor.

Cabbage, turnip, potato, and rape produce feed flavors in butter, the characters of which are indicated by their names. When present to a slight degree, these flavors are limited to a maximum flavor rating of 90.

“Weedy” flavors in butter are the result of weedy-flavored cream and are classified into two groups, namely, the ordinary common weeds which are found in most producing sections and the obnoxious weeds which are much more objectionable and confined to certain producing areas. Ordinary common weed flavor when present to a slight degree limits the flavor rating to a maximum of 90. When an obnoxious weed flavor is present to a slight degree, the flavor rating is limited to a maximum of 88.

“Onion” and “garlic” flavors are very objectionable. They are recognized by their peculiar taste and aroma suggestive of their names. When present to a slight degree, they limit the flavor rating to a maximum of 87.

ABSORBED FLAVORS AND ODORS THAT ARE THROUGHOUT THE MASS OF BUTTER

Because of their high fat content, cream and butter readily absorb and hold foreign odors and flavors. Such flavors may be present in butter to a slight degree or to a definite degree, depending on the character of the flavors and odors and the extent to which they have been absorbed.

A “musty” flavor may be absorbed by cream held in a damp cellar or cave. It may result from certain types of weeds, from feeding musty feeds, or from cattle drinking water out of slough holes and eating the rank growth of grass thereabouts. It may also result from insufficiently washed cream cans and separators. When present to a slight degree, the flavor rating is limited to a maximum of 90.

A “woody” flavor may be caused by the cream or butter absorbing a woody flavor from a new churn that has not been properly treated. It may also be caused

by packing butter in unparaffined tubs or cubes. When this flavor is present to a slight degree, it limits the flavor rating to 91.

FLAVORS OF OBSCURE ORIGIN

Flavors of an obscure origin are so classed because it is impossible to state definitely their source.

A "heated cream" (summer defect) flavor is usually caused by containers of cream being exposed to the hot sun, but may also be caused by the development of bacteria under certain conditions. When present to a slight degree, it limits the flavor rating to a maximum of 92.

A "flat" flavor in butter may be caused by mechanical operations, or it may be the result of the composition of the milk, or by feeds that do not have an aromatic flavor. Such butter lacks definite flavor and is low in volatile acidity. When present to a slight degree, it limits the flavor rating to a maximum of 92.

A "coarse-acid" flavor in butter may be expressed negatively as a lack of delicate flavor or aroma and is associated with an acid condition. A coarse-acid flavor and aroma are usually associated with butter made from cream in which slight acid development has taken place, necessitating a reduction in the acid content of the cream before pasteurization and, even though such cream is properly neutralized, the resulting product usually has a slightly coarse-acid aroma and taste. This flavor may also be caused by excessive ripening of the cream. This type of butter can readily be distinguished from acidy butter as there is no indication of sourness but it is slightly lacking in fine flavor. A slight coarse-acid flavor limits the flavor rating to a maximum of 92.

"Smothered" flavors are usually caused by improper cooling of the cream or lack of aeration of it. When this flavor is definite in character, it is rated 91.

A "bitter" flavor is one that produces a puckery sensation. It may be caused by the action of micro-organisms through the production of the enzyme lipase, or by the churning of cream that has been frozen and not properly thawed. When slight, this flavor limits the flavor rating to a maximum of 91.

An "old-cream" flavor in butter is usually caused by aged cream. It may also be caused by cans and utensils that have been improperly washed. An old-cream

flavor, when present in butter to a slight degree, limits the flavor rating to a maximum of 91.

A "stale-cream" flavor in butter is commonly caused by aged cream of poor quality. It may also be caused by faulty sanitation. When present to a definite degree, it limits the flavor rating to a maximum of 89.

A "barny" flavor, although commonly attributed to the absorption of cow-stable odors, may also be caused by certain bacteria or micro-organisms. When present to a slight degree, barny flavors limit the flavor rating to a maximum of 89.

FLAVORS AND CONDITIONS IN BUTTER THAT CAUSE IT TO BE CLASSIFIED AS "NO GRADE"

Butter that shows certain serious flavor defects or conditions, or that is below the requirements for United States 85 score, is classified as "no grade." The following flavors cause it to be classified as "no grade": Pronouncedly fishy, surface-taint, Limburger, tallowy, rancid, paint or varnish, chemical, gasoline, kerosene, and fly spray.

A flavor known as "surface-taint" is indicative of protein decomposition. This flavor is usually limited to the surface. "Surface-taint" may result from one or more of the following conditions: Too low a salt content in the butter, favoring the development of undesirable bacteria; too low an acidity of the cream at the time of churning, which favors development of protein-digesting bacteria; inefficient pasteurization; the introduction of raw cream into the pasteurized cream between pasteurizing and churning—leaks in the cream lines and in the linings of vats; the use of contaminated wash water; inefficient sterilization of the equipment; improper treatment of the wrappers and storing the butter at too high a temperature, thus favoring the development of any bacteria present.

A flavor that resembles the taste and smell of Limburger cheese, and occurs most frequently in unsalted or very lightly salted butter of low acidity is termed "Limburger." Limburger flavors may extend through the entire mass. The organisms that cause this undesirable flavor are of the protein-decomposing type. Limburger flavor may be caused by the use of contaminated or polluted wash water, the addition of un-pasteurized cream to pasteurized cream, contaminating material from cracks and crevices in vat covers and

stuffing boxes, unpasteurized cream in the outlet pipe, contaminated butter scraps added to the churn, or unsterile cream pumps, pipe lines, churns, and pieces of equipment that come in contact with the butter during the packing and cutting operations.

“Tallowy” flavor in butter has an odor and taste like tallow. It is usually caused by oxidation of the fats along with the catalytic effect of metals. It develops most frequently in butter that is distinctly alkaline. Where oxidation or catalytic action has taken place a bleached condition may be present below the surface, turning the butter white.

“Rancid” flavor in butter is indicated by a decomposed and volatile condition of the fat producing a very disagreeable flavor and odor that is often described as “strong.” Rancid flavor may be caused by a splitting of the fats by enzymes that result from micro-organic action.

“Paint” or “varnish” flavors in butter result from absorption or from addition of these foreign materials to milk or cream. Butter shipped in a newly painted freight car that has paint odors in it may absorb a “paint” flavor. Butter may also acquire a paint or varnish flavor when it is held in a creamery that has been freshly painted, especially if the butter is held without adequate refrigeration.

“Chemical” flavors in butter are acquired as the result of absorption or addition of such materials to the milk or cream, or the unfinished butter in the churn. In many instances such flavors can be traced to the treatment of churns with chlorine compounds, and to a lack of proper and thorough rinsing of the churn before loading. Such flavors may also be caused by treatment of liners with too strong a chlorine solution.

“Gasoline,” “kerosene,” and “fly spray” flavors in butter result from the absorption or addition of these foreign materials to the milk, cream, or unfinished butter in the churn. Butter will absorb gasoline, kerosene, and fly-spray odors when exposed to the air containing odoriferous substances from these products.

The following conditions cause butter to be classified as “no grade”: Mold, grains of sand, splinters of wood, specks of rust, and other foreign materials.

The presence of mold on the surface or in the butter is a serious condition. It occurs most commonly during the spring and early summer and appears as yellow, red, brown, green, or black spots which may spread and

which may penetrate through the liner and into the butter. It is a fungus growth that develops rapidly in a warm humid atmosphere. The curd in butter furnishes an excellent medium for its growth. Because salt retards mold growth, mold development is more rapid in unsalted than in salted butter. It is practically impossible to ascertain the exact depth to which the mold has penetrated and unless enough butter is removed to take off every particle of mold, it will develop again if conditions are favorable for its growth. The commercial value of butter, when mold is on the surface of it, is reduced by the cost of labor and the loss in weight of the butter incurred by the removal of the mold and the relining of the packages. Regardless of the nature and extent of the development of the mold either on the butter or packing materials, such butter should be classified as "no grade."

Butter that possesses grains of sand is very objectionable. The sand renders it unsalable except for refining or renovating purposes. For the most part, this condition is caused by grains of sand in the wash water which are incorporated in the butter. The sand may be detected by melting the butter on the tongue and by forcing it between the teeth. The sand will not go into solution.

Splinters of wood in butter are usually caused by a break in some of the inner mechanisms of the churn such as the rollers and shelves. They may also result from old churn drums that are severely splintered from heating the wash water with live steam through a hose or pipe. Occasionally, wooden particles are carried into the butter with the salt as the result of carelessness in opening the salt barrels, or by torn salt-barrel liners.

Specks of rust in butter are usually caused by rust forming on bolt heads or other metal parts inside the churn drum. Other possible sources are from water pipes, tanks, or wells, especially if the wash water is not strained through a cotton disk.

FACTOR OF BODY IN BUTTER

In grading butter, the factor of body is considered from the standpoint of its defects. Defects in body are rated according to their degree. The butterfat in milk is a mixture of various fats which are not always present in the same proportions. In spring, during the fresh-grass season the percentage of soft or low-melting-

point fats is larger and the churning temperature must be lowered if butter is to be in a firm condition. The butterfat in cream is present in the form of minute globules. During the churning process, the fat globules gather into clumps and form granules. When the cream is churned cold enough so that the fat is kept firm, and then the butter is worked sufficiently, the water will be present in the form of minute droplets throughout the mass of fat.

The character of the body is dependent largely on the character of the granules and their closeness or compactness as the result of working. The character of the granules is influenced by the physical properties of the butterfat, the rate of cooling, and the temperature to which the cream is cooled and held, the churning temperature, the temperature of the wash water used, and the size and condition of the granules when the washing of the butter is stopped.

The texture of the butter is dependent on the size of the granules and the manner and amount of working of the butter, as well as the physical properties of the butterfat.

In butter that has a perfect body the granules are closely united and when the butter is broken apart, it shows a firm, waxy, close-grained structure. From such butter a trier sample that is full and smooth can be drawn if the temperature conditions are right, and if a clean, smooth trier is used.

The most common defects in body are termed gummy, leaky, spongy or weak, crumbly, sticky, and ragged-borning.

“Gummy” butter, when placed in the mouth, does not melt readily because of the excessively hard fats present. Feeding cottonseed meal or whole cottonseed in quantities sufficient to supply the bulk of the protein in a ration will produce a high proportion of high-melting point fats and a hard-bodied butter. This condition becomes more intensified when cottonseed meal or hulls are fed with dry roughage. Succulent feeds and green pastures partly offset the effect of cottonseed meal and cottonseed hulls on the character of the fat.

A “leaky” (leaky-sticky, leaky-briny, and leaky-cloudy) body is indicated by drops of water that drain from the butter and appear as beads of moisture on its surface and the back of the trier. It is caused by in-

complete incorporation of the water in loose pockets between the granules. Despite the fact that leaky butter shows an apparent excess of free water, it may actually contain less moisture than properly worked butter of a higher moisture content in which the moisture is incorporated in a fine film over the granules and as finely divided droplets surrounded by fat.

A "leaky-sticky" body is indicated when the butter adheres to the back of the trier and shows large droplets of water. This condition may be caused by lack of proper cooling of the cream or too short a holding period together with insufficient working of the butter. It may also be caused by a wide spread between the temperatures of the granules and the wash water, especially if the granules are not held in the wash water a sufficient time to bring about a uniform temperature in the entire mass.

A "leaky-briny" condition is indicated by a briny-watery appearance on the surface of the butter and on the back of the trier. This condition is usually caused by adding dry salt to the butter coupled with insufficient working. It may also be caused by excessive salting of the butter.

A "leaky-cloudy" condition is usually caused by incomplete draining of the buttermilk together with lack of proper washing of the granules and insufficient working of the granules. This may also be caused by churning at too high a temperature bringing about very soft granules resulting in the retention of excessive buttermilk within the granules.

A "spongy" or "weak" body lacks compactness or firmness. This condition is generally due to a failure to cool the cream rapidly and to hold it at a proper temperature. The composition of butterfat varies considerably, especially when the cows are turned from winter feed to fresh green grass. On certain dry feeds, cows produce a higher percentage of hard fats and on fresh new grass they produce a higher percentage of soft fats. When butterfat containing a higher percentage of soft fats is churned the cream should be cooled rapidly and to a lower temperature and it should be churned at a lower temperature.

When a "crumbly" body is present the particles lack cohesion and the butter usually adheres to the trier leaving a rough appearance. This defect occurs most frequently during the late fall and winter and is

probably related to the composition of the butterfat. The temperature to which the cream is cooled, length of holding period, and churning and wash water temperatures are important factors to be considered in overcoming this condition. Sudden chilling of butter to extremely low temperatures immediately after churning likewise may cause crumbly-bodied butter.

When a "sticky" condition of the body is present, the butter adheres to the trier as a smear and when the trier sample is replaced, the trier becomes smeary throughout its length. This body defect is often associated with a crumbly condition and occurs most frequently in late-fall and winter butter. The temperature to which cream is cooled and held, rate of cooling, length of time cream is held before churning, temperature of wash water, and churning temperature are factors that are responsible, alone or in combination, for sticky butter. It may also be caused by a wide spread between the temperatures of the granules and the wash water, especially if the granules are not held in the wash water a sufficient time to bring about a uniform temperature in the entire mass.

A "ragged-boring" body in contrast to solid-boring is a sticky-crumbly condition that is present when a full trier cannot be drawn. It is most prevalent in winter when the percentage of hard fats is highest. Butter that rolls from the trier is described as ragged-boring. This condition is influenced by rate of cooling of the cream after pasteurization, the temperature at which the cream is held before churning, temperature of the wash water, or the churning temperature. Butter with a well-made close granular body may roll or ball up on the trier when sampled in a cold place or with a cold trier.

A "mealy" or "grainy" condition in butter refers to a granular consistency that is noticeable when butter of that character is melted on the tongue. Mealiness may be caused by a granular condition of the fat resulting from frozen cream, from melting and recrystallization of lumps of butter put into the cream vat before pasteurization, or by the pasteurization of the cream that is acid and in which a slight curdling takes place. It may also be caused by improper neutralization. Slow cooling of cream after pasteurization may also cause mealiness in butter.

FACTOR OF COLOR IN BUTTER

The color of butter is considered defective when it lacks uniformity or is higher than the natural color of butter when cows are on full-grass pasture. The natural color of butter varies according to seasonal and sectional conditions, but may be kept within certain limits by the proper use of butter color. A range in the natural color of butter is permitted without the color being rated as defective. However, when the color is uniform and is higher than a natural full-grass color a rating of 1 for defect in color is made. A very light straw color is not considered a defect. Defects in color are rated according to their degree.

“Wavy” color in butter is an unevenness in the color that appears as waves of different shades of yellow. Wavy color is caused chiefly by an uneven distribution of the water and salt in the butter. It may result from overloading the churn during the working process or from rollers that are improperly set or defective, thus causing an uneven working of the entire mass of butter in the churn. Using salt of a much lower temperature than the butterfat granules may also cause an uneven color. Adding wash water that is too cold to granules may also cause wavy butter, as it gives a firmer condition to the outside of the granule than the interior has from the original temperature.

“Specks” appear in butter as small white or yellow spots. White specks are small particles of curd, about the size of a pinhead, and may be due to faulty neutralization. When low-test cream is held at a comparatively high temperature, the skim milk has a tendency to settle and coagulate, forming curd that breaks up during churning into fine, hard, white particles that appear in the butter. Yellow specks or blotches may appear in the butter as spots of variable size. They may be caused by sediment in the color or by the granules which, lodging between the shelves and churn drum, are not well worked into the mass of butter.

“Mottles” appear as light-colored areas in the butter surrounded by more highly colored portions. They are caused by an uneven distribution of the salt, a lack of sufficient working, or adding too cold wash water to the granules. Mottles give the butter a marbled appearance.

"Streaked" color appears as long streaks of light-colored portions surrounded by more highly colored portions. Streaks are mainly caused by improper working or working that is insufficient to insure a thorough dissolving of the salt and a uniform incorporation of the moisture. They are also caused by adding to the butter in the churn at the time of working portions of previous churning that are of a different color.

FACTOR OF SALT IN BUTTER

The factor of salt in grading butter is considered from the standpoint of the degree of salt taste and whether it is completely dissolved. A certain range in the salt content or salt taste of butter is permitted without considering it a defect. This range provides for the various market preferences for salt content or salt taste in butter. When a definite sharp salty taste is present, it is rated 1 for defect.

Unsalted butter is not rated for defects in salt but is described on the grading certificate as "unsalted."

The principal defects in salt are a sharp salty and gritty condition. A sharp salty condition usually indicates an excessive salt content, particularly when the butter is free from a leaky condition.

A gritty salt condition results from undissolved grains of salt in the butter. It is readily detected by the gritty feel of the grains of salt that are present. Grittiness is due to too much salt, insufficient working, or insufficient moisture in the butter.

RATINGS OF DEFECTS IN BODY, COLOR, AND SALT

The defects in body, color, and salt are rated independently and entirely on their extent or degree. The ratings for the various degrees of defects in body, color, and salt are given in table 3.

TABLE 3.—*Rating of defects in body, color, and salt*

(Key of symbols: S=slight; D=definite; P=pronounced)

Defects	Ratings to be given for degree of each defect		
	$\frac{1}{2}$	1	2
Body:			
Gummy	S	D	
Leaky	S	D	
Spongy or weak	S	D	
Crumbly	S	D	
Sticky	S	D	
Ragged-boring		S	D
Mealy and grainy		S	D
Color:			
Wavy	S	D	
Color specks	S	D	
Streaks		S	D
Mottles		S	D
High color (unnatural)		P	
Salt:			
Sharp	S	D	
Gritty		S	D

The terms "slight," "definite," and "pronounced" are used to designate three degrees of defect. Numerical ratings of $\frac{1}{2}$ and 1 are given the following body defects: Gummy, leaky, spongy or weak, crumbly, and sticky. Ratings of 1 and 2 are applicable to ragged-boring and mealy or grainy body.

Numerical ratings of $\frac{1}{2}$ and 1 are given for wavy color, and color specks; streaks and mottles are rated 1 and 2; high color (unnatural) is rated 1.

Two defects are recognized in the factor of salt; namely, sharp and gritty. Numerical ratings of $\frac{1}{2}$ and 1 are given for sharp salt and 1 and 2 for gritty salt.

TOLERANCES FOR DEFECTS IN BODY, COLOR, AND SALT PERMITTED IN BUTTER OF CERTAIN FLAVOR RATINGS

In the distribution of butter in commercial channels of trade, defects in body, color, and salt are less important in butter that is below U. S. 90 score than in butter above that grade. Accordingly a tolerance for defects in body, color, and salt is permitted in butter

of certain flavor ratings without lowering the score below the flavor rating.

In butter with a flavor rating of 93 to 90, a defect of one-half is permitted in any one factor without lowering the final score below the flavor rating.

In butter with a flavor rating of 89 or 88, a total tolerance of 1 is permitted, which may consist of one-half in any two factors or 1 in any one factor.

In butter with a flavor rating of 87 or 86, a total tolerance of 2 is permitted, which may consist of one-half in each of two factors and 1 in a third factor, or 1 in each of two factors or 2 in any one factor.

In butter with a flavor rating of 85, a total tolerance of 3 is permitted, which may consist of 1 in all three factors or 1 in one factor and 2 in one other factor, or 3 in any one factor.

CONTAINER, FINISH, AND APPEARANCE

The condition of the container in which butter is packed and the finish and the appearance of the butter may add to or detract from their attractiveness. The container is not a constituent part of the product, nor is the quality of butter dependent on the type or style of the container. Under certain conditions, the price of a particular lot of butter may be influenced by the container and by the finish and appearance of the butter. When this is the case, the buyer and seller may well consider them in negotiating the price.

The type or style and the condition of the container and the finish and appearance of the packing should not be considered a factor in determining the score or grade of butter but should be described on the grading certificate.





